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A Prospective Study of Combined Spinal and Epidural Anaesthesia for Hip and Major Lower Limb Surgeries in Elderly Patients

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Abstract:
Introduction: *The combined spinal epidural technique involves intentional subarachnoid blockade and epidural catheter placement during the same procedure. Ideally it combines the best features of spinal and epidural blockade and avoids their respective disadvantages. With the combined spinal epidural techniques, surgical anaesthesia was rapidly established saving 15 to 20 minutes, compared with epidural anaesthesia. This study attempts to qualitate the newer regional anaesthetic approaches with regard to the provision of adequate anaesthesia and analgesia with minimal side effects.*
Aims & Objectives: *1To evaluate the safety and efficacy of combined spinal-epidural anaesthesia in lower limb surgeries. To find the regional anaesthetic technique that provides adequate surgical anaesthesia and analgesia with minimal side effects.*
Observations: *1.Onset of action was significantly faster.2.The total volume of the Local anaesthetic drug required was very less.3.The duration of analgesia was longer and superior.4.Patients were haemodynamically more stable.5.Complications were minimal.6.Higher satisfaction rate among patients and surgeon.*
Keywords: *CSE, Time of onset & duration of analgesia, motor lockade.*

I. Introduction

Most of the lower limb surgeries are conducted under spinal or epidural anaesthesia. The disadvantages of spinal (i.e. single shot nature, unpredictable level of blockade, time limit) and epidural anaesthesia (i.e. missed segments, incomplete motor block, poor sacral spread, local anaesthetic toxicity, time consuming) led to the development of combined spinal epidural anaesthesia.

The combined spinal epidural technique involves intentional subarachnoid blockade and epidural catheter placement during the same procedure. Ideally it combines the best features of spinal and epidural blockade and avoids their respective disadvantages.[1,2] With the combined spinal epidural techniques, surgical anaesthesia was rapidly established saving 15 to 20 minutes, compared with epidural anaesthesia.[3]

Combined spinal epidural is a relatively new technique of regional anaesthesia by which main advantages of subarachnoid block and epidural are retained and combined.[1]It gained increasing interest as it combines the reliability of a spinal block and flexibility of an epidural block. Combined spinal epidural anaesthesia is characterized by a shorter latent period, a lower dose of local anaesthetics requirement and a higher reliability[3], which uses combination of techniques to accomplish the ideal kind of anaesthesia for patients of all age groups.

This study attempts to qualitate the newer regional anaesthetic approaches with regard to the provision of adequate anaesthesia and analgesia with minimal side effects.

II. Aims & Objectives

1. To evaluate the safety and efficacy of combined spinal-epidural anaesthesia in lower limb surgeries.
2. To find the regional anaesthetic technique that provides adequate surgical anaesthesia and analgesia with minimal side effects.

III. Patients And Methods

Study pattern:

This prospective study was conducted in the Department of Anaesthesiology in association with Departments of Orthopedics, Government General Hospital, is a tertiary teaching hospital affiliated to Guntur Medical College, Guntur from August 2014 to May 2016. Clearance **was** obtained from hospital ethics committee for the study. Informed consent was obtained from all the patients.

The study of 100 consecutive patients coming for elective Orthopedic, **hip and major lower limb surgeries were** included.

Patient selection:
Inclusion criteria:
1) Age group 20 - 60years of both **sexes.**
2) Patient under ASA I and II
3) Patients posted for various elective surgical procedures of lower limb in which regional anaesthesia is required.

Exclusion criteria:
1) Patients who are known sensitive to bupivacaine
2) Patients on anticoagulant therapy.
3) Patients with bleeding diathesis
4) Patients with infections on the back
5) Patients with spinal deformities
6) Patients with history of peripheral neuropathy.
7) Patients with CNS disorders.

IV. Methodology

All the patients were given oral alprazolam 0.25mg 2 hrs prior to surgery as premedication. In the anaesthetic room, an 18 gauge IV cannula was established and the patient was preloaded with 500 ml Ringer lactate solution over a period of 20 to 30 mins. Basal vital parameters like pulse rate, blood pressure, respiration, 0_2 saturation were recorded.

The patient was positioned in lateral position with the help of an assistant. Under aseptic conditions the back was prepared with 5% povidine iodine solution, spirit and the area was draped. The L3-4 interspace was identified; skin was infiltrated with 2ml of 1% xylocaine.

Procedure:

After infiltration of local anaesthetic, by using needle through needle technique, with a 18 gauge 'Tuohy' needle, epidural space was identified with loss of resistance to air technique and confirmed with a hanging drop technique. Then a 27 G long 'Whitacre' Spinal needle was introduced through the epidural needle, to locate the subarachnoid space and 10 mg of 0.5% bupivacaine (heavy) was deposited in the subarachnoid space. After withdrawing the spinal needle carefully a 20G epidural catheter was threaded through the epidural needle into the epidural space in cephalad direction up to about 3 to 5cm. The epidural needle was slowly pulled out without disturbing the catheter. The catheter was well secured with plaster and patient was positioned.

After positioning the patient in supine position the level of sensory blockade was checked by loss of sensation to pin prick. Time of onset of motor blockade was checked by Bromage classification and injection 0.5% Bupivacaine 8 ml injected epidurally to attain the adequate level of blockade.

Parameters studied:
The following parameters are studied
1) Assessment of sensory blockade: Sensory blockade was assessed by pinprick and time noted for the block to reach different dermatomal level.
i) Onset of sensory block
ii) Maximum height reached and time required.
iii) Duration of analgesia
iv) Quality of analgesia

2) Assessment of motor block : Motor blockade was assessed by Bromage scale.
a) Time required for complete recovery

3) Volume and dose :
I. Total volume (ml) of local anaesthetic (Initial dose + top-up doses]
II. Total dose(mg) of local anaesthetic
4) Duration of combined spinal epidural anaesthesia
5) Hemodynamic changes
6) Complications:

The patient were carefully monitored intraoperatively for any untoward effects like inadequate block; hypotension, bradycardia, respiratory distress. Nausea vomiting, restlessness, pruritus, shivering, anaphylactic reaction, Cardio respiratory catastrophe, inadvertent spinal, dural puncture, vascular injury, and catheter related

problems (kinking, inability to thread, migration, fragment etc.). Patients were watched postopertively for 72 hours for any PDPH, backache, transient neurological symptoms.

In our study, when the patient initially complained of pain, they were given VAS and were asked to express the intensity of pain on the scale. When it reached >4 mark on the scale, they were allocated to receive the rescue drug. Visual Analogue Scale (VAS) was used to assess the intensity of pain and pain relief. This scale consisted of a 10 cms line, marked at 1cm each, on which patient expresses the degree of pain by placing a point. Mark "0"represents no pain and mark "10" represents worst possible pain.

Postoperative analgesia:

All patients were post operatively given 0.125% injection bupivacaine through epidural catheter and were monitored for 72 hours for any complications.

V. Observations and results:

Table : Age distribution

Age in Years	Male	Female	Total
60-65	44	28	72
66-70	11	10	21
71-75	0	1	1
76-80	3	3	6
Total	**58**	**42**	**100**
Mean age ± SD	**63.90 ± 4.916**YRS	**65.45 ± 5.478** YRS	**64.55 ± 5.190**YRS.

Table Shows The Age Distribution In Our Study. It Was Observed That, The Mean Age For Male Was 63.90 ± 4.916 Yrs And For The Female Was 65.45 ± 5.478yrs. The Overall Average Age In Our Study Was 64.55 ± 5.190 Yrs. In Our Study Male Were 58% And Female Were 42%.

Height distribution

Height in cm	Male	Female	Total
< 150	**0**	**1**	**1**
151-160	**0**	**29**	**29**
161-170	**22**	**21**	**43**
> 171	**25**	**2**	**27**
Total	**47**	**53**	**100**
Mean Height ± SD	**170.5 ± 3.4**	**160.9 ± 5.1**	**165.4 ± 6.5**

Table II and Graph II shows the height distribution in our study. It was observed that, the average height for male was 170.5 ± 3.4 cms and female was 160.9 ± 5.1 cms. The overall average height was 165.4 ± 6.5 cms.

Table : Onset of sensory analgesia

Onset time (min)	Number
2	**21**
3	**37**
4	**28**
5	**9**
6	**4**
Failure	**1**
Mean time± SD	**3.4 ± 1.0 min.**

The above table shows the onset of sensory analgesia (min) in number of patients. Greater number of patients had onset of sensory analgesia was within 3 mins. The overall mean onset of sensory analgesia in our study was 3.4 ± 1.0 min. In our study one patient does not show the initial onset of sensory analgesia was considered that the failure of the spinal component of combined spinal epidural technique.

Onset of motor blockade (Bromage classification)

Bromage grade	Range in min	Mean ± SD in min
I (0%)	**1-5**	**2.9 ± 1.0**
II (33%)	**1.5-6**	**3.9 ±1.0**
III (66%)	**2-8**	**4.7± 1.2**
IV (100%)	**3-8**	**5.8 ± 1.1**

Table shows the onset of motor blockade by Bromage classification. The mean duration to achieve 100% (grade IV) motor blockade was 5.8 ± 1.1 min.

Table mean of pulse rate

Time min	Pulse rate + SD/min
0	**85.7 ± 9.8**
5	**85.8 ± 10.2**
10	**83.2 ± 14.5**
15	**81.2 ± 12.3**
45	**81.3 ± 9.5**
60	**80.2 ± 8.3**
90	**80.8 ± 9.4**
120	**81.2 ± 9.6**
150	**79.9 ± 9.1**
180	**79.3 ± 8.7**
210	**79.7 ± 7.5**

The Table shows the intraoperative mean pulse rate ± SD per min. There is no significant change in the pulse rate.

intraoperative mean systolic pressure ± SD mm Hg. Intraoperative systolic pressure shows a decline to 113.1 ± 8.2 mm Hg. There is no significant fall in the systolic pressure in our study. The intraoperative mean diastolic pressure changes. The mean of diastolic BP at the start of procedure was 79.8 ±7.1 mm Hg. The intraoperative mean of diastolic BP show a decline of 72.3 ± 4.8mm

Average extension of sensory blockade after epidural top up

Increase of segments	No. of eases
1	4
2	57
3	22
4	11
5	5

The above table shows the extension of sensory blockade after administration of the epidural drug. In our study 57patients shows the extension of two segments after epidural injection followed by 22 patients shows 3 segments extension. The overall average extension of sensory blockade after epidural top up was 2.6 ± 0.9 segments.

The extent of sensory blockade under spinal dose range from T7 to T11 with the average of T10. The extent of blockade showed a definite cephalad rise under the influence of epidural drug. The level of sensory blockade after epidural top up range from T_5 to T_9 with the average of T_7.

Total duration of C.S.E. (complete recovery)

Time duration min	No. of patients
200-250	13
251-300	63
301-350	20
351-400	4
Total	100

The above table shows time taken for complete recovery.In our study 63% of patients had complete recovery from the blockade in 251-300 min. 20% of patients had complete recovery from the blockade in 301-350 min. 13% of patients had complete recovery from the blockade in 200-250 min and 4% of patients had complete recovery from the blockade in 351-400 min.

The mean ± SD of time required for complete recovery from the blockade was 291.3 ± 29.9 min.In our study, 2% of patients had hypotension and were treated with injection mephenteramine 6mg and 5% of patients had bradycardia and were treated with injection atropine 0.6mg. 3% of patients had shivering and were treated with injection Midazolam 2mg and 5% of patients had nausea and was treated with injection ondansetron 4mg. Rest of them did not have any other effects. No incidence of post-dural puncture headache occured in our study.

Postoperative pain relief

Comfort	No. of patients (%)
Excellent	**42 (42%)**
Good	**53 (53%)**
Fair	**5 (5%)**

Tableshows the postoperative pain relief by patient feed**back** method.In our study we are using 0.125% bupivacaine in 4 hourly interval upto 72 hours for postoperative pain relief. By patient feedb**ack** questionnaire

by using VAS score, 53% **of** patient's opinion was good and 42% of patient's opinion was excellent regarding postoperative pain relief. Only 5% of patient experience fair regarding postoperative pain relief.

VI. Discussion

Many authors have studied the C.S.E. block in patients with regard to onset of analgesia, level of sensory blockade, maximum level, quality, total duration of analgesia with haemodynamic changes and complications.

The present study was undertaken in 100 patients of age group 20 to60 years posted for major lower limb surgeries.

Onset of block:

The mean time of onset of analgesia in C.S.E. observed by various authors[7]ranged from 2 to 15 min. Holmstrom B. et al 1993[9] found the mean onset time of sensory-blockade was 4.5 ± 2.0 min and in another study, Hamdani et al 2002[26] found the mean onset time of sensory blockade was 3.8 ± 2.6min. In the present study, 95% of the patients mean onset time of sensory analgesia was 3.4 ±1.0 min. In all the studies, the drug used was 0.5% bupivacaine. The significant faster onset in C.S.E. was due to intrathecal bupivacaine, which helps, in early optimal conditions for surgery.

Maximum Height reached after subarachnoid block.

Nightingale et al (1981)[51] found the maximal level of analgesia in the range of $T_4$to $T_{12}$with mean level of T_8. Veering et al (1988) found the maximal level of analgesia in the range of T_8 to T_{10} with an average of T_9. In the present study, we used 2 ml of 0.5% hyperbaric bupivacaine. The maximal level of analgesia achieved was in the range of T_7 to T_{11} with an average of T_9.

Enhancement of sensory block by epidural dose in C.S.E.

Several studies have shown that analgesia levels obtained after subarachnoid injections of a hyperbaric local anaesthetic solution followed by minimal dose of epidural drug are higher than when performing either technique individually.

Enhancement of block after epidural dose

Author	Spinal	Epidural	Max segm	Max se
KeshavSharma et al(1994)	2.5ml 0.5%Bupivacaine(Heavy).	8ml of 2% lidocaine withadrenaline	T_8	T_5
Stienstra et al(1996)	2ml of 0.5%Bupivacaine	10ml of 0.5%Bupivacaine	T_{10}	T_5
Steinstra et al(1999)	2ml of 0.5%Bupivacaine	5ml of 0.5%Bupivacaine	T_8	T_5
Sivasenthil(2000)	2ml of 5%lidocaine	10ml of 0.5%Bupivacaine	T_8	T_3
Hamdani etal (2002)	1ml of 0.75%Bupivacaine	2ml of 0.5%Bupivacaine or even[1] unblocked segment	T_{10}	T_6
Our study	2ml of 0.5% Bupivacaine	8ml of 0.5% Bupivacaine	T_{10}	T_7

Onset of Motor blockade:

Time of onset of Motor blockade

Author	C.S.E. min	Drug used
Nickalls RWD (1994)	**3.7±1.9**	**5% lidocaine and 0.5% Bupivacaine**
Our study	**5.8±1.1**	**0.5% bupivacaine (H) 0.5% bupivacaine**

Bromage classification was used to assess the motor blockade. In our study the duration of onset of motor blockade was from 3to 8 min with an average of 5.8 ± 1.1 min.

Duration of Analgesia

In our study, 2 ml of 0.5% Bupivacaine (heavy) was used for intrathecal and 8 ml of 0.5% Bupivacaine for epidural blockade. The analgesia lasted from 250-350 minutes.

In most of the studies of C.S.E., the authors have used 0.5% bupivacaine (heavy) for spinal and further epidural top-up was continued with 0.5% bupivacaine.

Duration of analgesia (C.S.E.)

Author	Spinal	Epidural	Duration in Minutes
Stienstra et al (1996)	2ml of 0.5% Bupivacaine.	10ml of 0.5% Bupivacaine.	230 ±10.2
Sivasenthil (2000)	2ml of 5% lidocaine (heavy)	10ml of 0.5% Bupivacaine.	130±18.2
Hamdani et al (2002)	1ml of 0.75% Bupivacaine	2ml of 0.5% Bupivacaine for every unblocked segment	210±6.7
Blumgart et al (2002)	2.5ml of 0.5% Bupivacaine (H)	8ml of 2% lidocaine with adrenaline	107±13.8
Our study	2ml of 0.5% Bupivacaine (H)	8ml of 0.5% Bupivacaine	291±29.9

Stienstra et al (1996), reported the duration of analgesia was 230 ± 10.2 min as they used 2ml of 0.5% bupivacaine (heavy) for spinal and 10ml of 0.5% bupivacaine for epidural top up. Our study correlates with this study as we used the same drug for spinal and epidural. We recorded the duration of analgesia was 291 ± 29.9 min.

Volume and dose of drug:

The volume of drug used in C.S.E. by various authors for epidural top up was 8 to 10ml after the intrathecal injection of 2-2.5ml of local anaesthetics. In our study, the volume of drug used for epidural top up was 8ml of 0.5% bupivacaine after the intrathecal injection of 2ml of 0.5% bupivacaine (heavy) For one case we used 8±8 ml of 0.5% bupivacine epidurally due to failure of spinal component of C.S.E. This clearly shows that the smaller total volume of drug is a definite advantage in favour of C.S.E.

Volume of drug :

	C.S.E.	
Author	Spinal dose	Epidural dose
Keshav Sharma et al (1994)	2.5 ml of 0.5% Bupivacaine (H)	8ml of % Lidocaine with adrenaline.
Stienstra et al (1996)	2ml of 0.5% Bupivacaine	10ml of 0.5% Bupivacaine
Sivasenthil (2000)	2 ml of 5% Lidocaine	10 ml of 0.5% Bupivacaine
Hamdani et al (2002)	1ml of 0.75% Bupivacaine (H)	2ml of 0.5% Bupivacaine for every unblocked segment
Our study	2ml of 0.5% Bupivacaine (H)	8ml of 0.5% Bupivacaine

Hemodynamic Changes:

Authors	C.S.E.	Bradycardia	Hypotension
Keshava Sharma 1994	2.5 Ml Of 0.5% Bupivacaine (H)-8ml - 2% Lidocaine With Adrenaline	Nil	11%
Our Study	2ml Of 0.5% Bupivacaine (H) + 8ml Of 0.5% Bupivacaine	5%	2%

Various authors have studied the haemodynamic changes in C.S.E using different drugs. Bradycardia was nil in almost all cases and percentage of hypotension was also minimal. In our study 2% of patients developed hypotension and 5% of patients developed bradycardia. In those patients the blockade height reached the T5 segmental level. The rest of the patients were haemodynamically stable. Thus the C.S.E. technique offers an advantage of haemodynamic stability.

Complications:

In our series of clinical study; we didn't come across cardio respiratory catastrophes, total spinal, inadvertent puncture of dura or kinking of catheter. In our study, one case was continued with epidural because dural puncture was not possible and considered as a failure of spinal component of C.S.E.

Post operative pain relief:

Author	C.S.E. Epidural top up for postoperative analgesia	Analgesic score
Gaushar et al (2002)	Bupivacaine 0.125% 8 to 10 ml 4^{th} hr.	Poor-Nil. Fair. 3(10%) Good. 20(67%) Excellent 6 (20%)
Our Study	Bupivacaine 0.125% 10 ml 4^{th} hr.	Poor-Nil Fair. 5% Good 53% Excelient-42%

Gaushar et al (2002), used 8-10ml of 0.125% bupivacaine 4^{th} hour interval as epidural top up in the recovery room for postoperative pain relief. They reported 67% of patients experienced good, 20% experienced excellent and 10% experienced fair overall postoperative pain relief. When comparing our study with Gaushar et al, we used the same concentration and volume of drug every 4^{th} hourly and we found that 53% of patients experienced good, 42% experienced excellent and 5% experienced fair overall postoperative pain relief. None of the patient developed any untoward effects like nausea, vomiting. Shivering in the postoperative period.

VII. Summary

The clinical study was conducted on ASA I and II adult patients of both sexes in the The onset of analgesia was 3.4±1.0 min. The epidural dose caused further ascent of sensory analgesia by three to four segments with an average of 2.6 ± 0.9 segments. The time taken for the onset of the motor blockade was 5.8 ± 1.1 min. The time taken for the complete recovery from the C.S.E. was 291.3 ± 29.9 min. Only 5% of patients developed bradycardia and 2% of patients developed hypotension. The remaining patients were haemodynamically stable throughout the study period.

There were no untoward effects except shivering in 3% patients and nausea in 5% patients in our study. 53% of patients experienced good, 42% experienced excellent and 5% experienced fair overall postoperative pain relief. 59% of patients and 71% of surgeons gave very good feedback about C.S.E in terms of postoperative pain relief, speed of onset and relaxation. Combined Spinal Epidural is an useful technique with good operating conditions, with minimal complications and patient comfort for lower limb orthopedic procedures.

VIII. Conclusion

1. Onset of action was significantly faster.
2. The total volume of the Local anaesthetic drug required was very less.
3. The duration of analgesia was longer and superior.
4. Patients were haemodynamically more stable.
5. Complications were minimal.
6. Higher satisfaction rate among patients and surgeon.

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